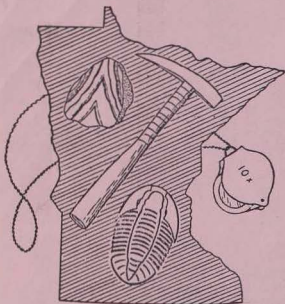


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NEWS



Geological Society of Minnesota

Marcia Gunville, editor  
1110 Gardena Ave.  
Fridley, Minn. 55432

FIRST CLASS



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April-May-June, 1978

## OFFICERS

PRESIDENT	Marlys Lowe	2206 Caroline Lane, So. St. Paul	451-2822
VICE PRES.	Bob Handschin	2029 Edgerton Road, St. Paul	774-1431
SECRETARY	Bill Miller	425 S.E. 13th Ave., Apt. 403, Mpls.	331-3263
TREASURER	Bob Leacock	1235 Brighton Sq., New Brighton	636-2473
DIRECTORS	Myrtle Fore	4356 30th Ave. S., Mpls.	722-5650
	Barbara Gudmundson	5505 28th Ave. S., Mpls.	722-9132
	Mark Jeffreys	9509 5th Ave. S., Mpls.	888-1274
	Sr. Joan Kain	1035 Summit Ave., St. Paul	225-3000
	Allen Lundgren	765 Redwood Lane, New Brighton	633-5442

ECOLOGY is the study of relationships between organisms and their environment. The community of organisms which occupies a defined region often interacts in unusual and complex ways. Such a complex web of interrelationships might be described as follows:

1. Healthy British men are nourished by roast beef.
2. Cattle, supplying beef, feed on clover.
3. Clover is pollinated by honeybees.
4. Honeybee nests are destroyed by field mice.
5. The number of field mice depends on the number of cats (which eat mice).
6. The number of cats depends on the number of old maids (who keep cats).
7. Therefore, the number of healthy British men is dependent on the number of old maids.

## FIELD TRIPS

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The summer field trip season is under way. After a very successful first trip, we are looking forward to the remaining three events. They are:

Sat., July 22 -- Caves and the related geology of Southern Minnesota with Dr. Calvin Alexander, Univ. of Minn. This trip will be an all-day trip by car.

There will be no limit on the number of people who can attend. Persons wishing transportation should make car-pool arrangements with others.

Sat., Aug. 5 -- The geology of the upper Mississippi River Valley with Dr. Robert Sloan, Univ. of Minn. This trip will be an all-day bus trip and will be limited to 16 people, the capacity of the bus. A \$5.00 deposit will be required.

Sat.-Sun., Sept. 9-10 -- A weekend of canoeing on the Kettle River, headquartering at the Northwoods Audubon Center near Sandstone. We will be led by the Center naturalist, with canoes, four meals and overnight lodgings all included in the \$25 package price.

Because the field trips are increasing in popularity, Bob Gunville, chairman, will be establishing a new reservation system. This system should be fair to all who want to go.

Since the Aug. 5 and Sept. 9-10 trips have limited enrollments, he will personally take reservations by phone only on or after a specified date, first come first served. Reservations will be confirmed only after Bob receives the requested deposit. Callers will be giving information only, and will contact everyone in ample time. They will not be authorized to accept reservation. Information for both the Sloan and Northwoods trips will be given out with the same call, which will start right after the July 22 trip is over.

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## IMPORTANT

### RESERVE ANNUAL MEETING DATE

Check your calendar now to make sure you have reserved Monday, Sept. 25 for the G.S.M. Annual Meeting. Once again it will be held at the Viking Village. Watch for the announcement in the next newsletter.

### BY-LAWS REVISION TO BE VOTED

The G.S.M. Board of Directors appointed an ad hoc committee to review and update the By-Laws of the Society. Approval was given by the Board for the revised and restructured By-Laws as stated in this newsletter. Voting by the membership will take place at the Annual Meeting in September.

## People in the Spotlight

Sister Joan Kain, G.S.M. board member since 1974, is the author of a geology guidebook of downtown St. Paul and its building stones. Her new book has just come off the press.

The book is entitled *Rocky Roots, Three Geology Walking Tours of Downtown St. Paul*. Published under the sponsorship of the Ramsey County Historical Society, it deals with both the geology and the architecture of the buildings represented. The purpose of the book is to show how a number of downtown buildings illustrate both their architectural history and the geological history of their stones. Sister Joan also writes about the history of the quarrying industry itself.

She has chosen 58 buildings for inclusion, and has organized them into three separate walking tours. Tour 1 is called "On the Hill", tour 2 is "Lowertown", and tour 3 is named "Capitol Complex". Maps and outlines of the routes show the walker exactly where to find the buildings. Pictures of each building point up the details being discussed.

Sister Joan's walking tour guide is available for \$1.00 at the Ramsey County Historical Society, the Gibbs Farm Museum, the St. Paul Arts and Sciences Center, and the Architectural Library. Or you may contact her personally if you would like to obtain a copy.

## welcome

### NEW MEMBERS:

We would like to extend a warm welcome to the following new members of the G.S.M.

Nancy Balaban  
528 Ashland Ave.  
St. Paul, MN 55102

Margaret Barrott  
7 N.E. 5th Ave.  
Forest Lake, MN 55025

Alice L. Chapin  
3921 Bryant Ave. S.  
Minneapolis, MN 55409



*Let's get acquainted!*

### LOOKING AHEAD!

Lectures for next year will begin Monday, Oct. 9. Dr. G. F. Webers, Macalester College, will give seven lectures on "Plate Tectonics and Earth History". Dr. David Southwick, Minn. Geological Survey, will give five lectures on "The Precambrian: Evolution of the Continental Crust".

Both Dr. Webers and Dr. Southwick are old friends of the G.S.M. We have always enjoyed their outstanding teaching and stimulating field trips. We are looking forward to their lectures very much.

NOTE: Dr. Webers plans to use the paperback textbook, *Continents Adrift and Continents Aground*, with introductions by J. Tuzo Wilson, W. H. Freeman & Co. You might want to obtain a copy of this book before the first lecture Oct. 9. It has been available at the University of Minn. bookstore and The Hungry Mind. Or you can order it from your local bookstore.

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SOUTHEASTERN MINNESOTA, PAST, PRESENT AND FUTURE --  
A FIELD TRIP EXPOSURE TO A CHANGING LAND

by Marcia Gunville

Sediments completely dominate Southeastern Minnesota. Sediments cover everything in sight, both at the land surface and as far into it as the deepest rivers have cut. Hundreds of millions of years ago seas covered this part of the continent, depositing these sediments in unknown thicknesses. Erosion and deposition have been affecting the surface ever since, but today enough material still remains so that the bottom of this sedimentary blanket in Southeastern Minnesota is far below ground level.

Last August Dr. Robert Sloan, Univ. of Minn. Dept. of Geology, led the G.S.M. on a field trip through this area he knows so well. Through his eyes we watched the landscape being built up and torn down over geologic time in response to ever-changing earth forces.

Our imaginations allowed us to swim along the bottom of the sea which covered it in the Cambrian, and watch worms burrowing after their trilobite dinners. Both worms and trilobites left tracks in the then soft sediments. We could see the present day remains of the dinners of these Cambrian worms as the green glauconite in the Franconia greensand. Clay particles, which had been swallowed by worms, had become-altered in their digestive tracts to this dull green mineral. We pictured ourselves here on an Ordovician Minnesota tropical beach as winds sand-blasted the tiny grains of sand by blowing them against one another, and waves deposited them on the Bahama-like sea floor.

We bore witness to an earth-shattering Ordovician volcanic explosion somewhere in the region of Eastern Tennessee. This explosion shot out four to five times as much debris as did Krakatoa, raining some of it down at least as far away as we stood, perhaps 1200 miles from the volcano. In 1883 the Krakatoa eruption blew up an entire Indonesian island, sent up rock and ashes for 17 miles or more, and affected the earth's atmosphere causing spectacular sunsets for three years. This one was far greater.

We recognized the post-Platteville warping and faulting of the earth's crust on the Red Wing-Rochester anticline, and saw some of its effects. At Barn Bluff in Red Wing, the rocks cracked and moved vertically 150 feet along a large fault. The rocks all along the crest of the anticline were crushed and broken up most severely during the upwarping. Much later, Cretaceous streams found this weakness in the rocks and flowed through here. They cut large valleys and drained the area after it had become land. These streams were moving toward a now vanished western sea. Their channel bottoms still are traced by the sediments they deposited.

Glaciers obviously had covered the land surface most recently. Their characteristic till lay on the top. In some places the topography resembled the bumpy and irregular landforms of the Twin Cities, left this way by the last glacial advances. In other places such knobs and kettles had been worn away. The older surfaces were smoother, with only the larger boulders of an earlier glacial till remaining unmoved by erosional forces.

The landscape continues to change dynamically. An act of piracy took place here in the very recent geologic past. Hay Creek, which runs over the broken up rocks along the crest of the Red Wing-Rochester anticline today, cut through a land barrier and stole the headwaters of Wells Creek. This actively eroding stream kept advancing headward until it took away the divide between its own and Wells Creek's drainage areas. This intrusion trunkated Wells Creek and caused its headwaters to be diverted into Hay Creek's drainage system. Hay Creek is still actively eroding and is about to do it again. It needs to cut through only about 50 feet of rock separating it from another segment of Wells Creek. What will this place look like in perhaps 500 years?



This narrow divide may be gone and Wells Creek may become even shorter as its headwaters, now flowing east, are diverted northward into Hay Creek.

Learning the rock column is a basic part of understanding what has happened here. Sediments are laid down on top of one another in a sequence from older to younger. The order will be the same everywhere in an area unless something unusual has happened. From this order we can deduce both conditions existing during deposition and movements of the earth's crust since that time. Dr. Sloan helped us to recognize the various Cambrian and Ordovician formations, and their proper order, not only at field stops but also in road cuts and stream banks as we drove along. Sometimes a formation appeared low in one place, perhaps at road level, and later occurred at the top of a hill. There would be a reason for this. Perhaps an erosional agent, such as a stream, had cut deeply into the rocks and the road was descending, or perhaps the rocks had been structurally warped or faulted.

We learned how to watch as one kind of rock would gradually disappear and the next higher, or lower unit of the column came into view. If the rock type changed, something probably happened during the time of deposition to cause this. Did sea level rise or fall? Did weather conditions gradually alter? Did land masses, even continental positions shift? Changes in rock types must be carefully mapped before the area's geologic history can be worked out. With Dr. Sloan to guide us we began to see how the pieces of the puzzle could be fitted together into a coherent story.

Characteristic fossil assemblages are important clues in identifying rock types, as well as rock ages. We could appreciate this, even without learning the finer intricacies of different Cambrian or Ordovician habitats and which "critters" were eating what, or whom. We had fun lying on our bellies in the roadside ditch near Cannon Falls, searching for fossils in the ancient mud beds of the Decorah Shale. We were warned very specifically by our leader to be careful where we put our feet in order to avoid obliterating the fossil evidence. Grass was all right. Dried up mud was not.

He also showed us how to split a rock slab and look at it in order to maximize the likelihood of actually finding fossils in it. The pick end of the hammer is not very useful in breaking up the large slabs we'd like to have. A good sledge and chisel is better. Then he told us to hold up the flat surface of the slab in a direct line with the sun, allowing the sun's rays to travel across the entire plane toward our eyes. This would put 50% of the rock in sun and 50% in shadow, creating the most visual relief along the surface. If fossils are there, they will pop into view most readily in this light.



Since life forms evolve over time, we might expect slow changes in fossils from older to younger rocks. Sometimes, however, the changes are sudden and dramatic. Usually this is a clue that something happened to the environment at the time of these sudden changes. The Ordovician volcanic explosion was such an event. Dr. Sloan told us that when this occurred and the ash rained down over the entire eastern half of North America, all things living there were instantly killed. Their remains exist today only as a faint odor of petroleum at the bottom of the layer of weathered volcanic ash (Bentonite).

The fossil record was altered by this explosion. All species inhabiting only eastern North America became extinct at that one moment of time. The fossil record of these species ends abruptly at this volcanic ash bed. Above the Bentonite layer a number of new species appear. With little or no competition to stop them, new creatures came wandering in from the outside and soon filled the ecological gap. Still other types of fossils are found both above and below this ash bed barrier. These types of animals existed in both eastern and western North America, so replacement animals were available.

Such a widespread volcanic ash layer makes an excellent time marker in the rock column. Since it was laid down everywhere at the same moment, it identifies which rocks were then being deposited or eroded. Clearly defined moments in time such as this are infrequent in the rock record, and are very useful to geologists in correlating events over wide areas.

Fossils do not always have to be very old, preserved forms of animal life. They might be preserved bits of leaves, twigs, pollen grains, or even small parts of earlier environments. Dr. Sloan showed us some possible "fossils" in the making. A dried up mud puddle was the evidence. There we saw how the mud had cracked in characteristic shapes and curled along the edges, indicating which direction was up. Scattered raindrops also had left their impressions in the soft mud. Should the surface of this mud puddle become buried, it might remain for posterity as evidence of a present day rainstorm. Mud cracks and raindrops of the past are commonly found in sedimentary rocks.

During the Cretaceous, streams cut channels through almost all the many hundreds of feet of Ordovician rocks still present today in other places. Extreme weathering conditions reduced their sediments to clay. They are the source of the Red Wing pottery clay. They also are filled with low grade iron ore, formed when iron from weathered rocks could not be oxidized because it was in a reducing, bog environment.

This rural Minnesota hillside, once the bottom of a Cretaceous stream, is not considered a good example of Cretaceous sediments by Dr. Sloan. However, he said it was one of the better ones of only about 200 in Minnesota. He might expect to find in it a few fish or frog bones, some bits of leaves or pollen, perhaps shark's teeth, or even middle Cretaceous mammal's teeth. Something like a dinosaur bone would be a rare find. He spent many years studying these sediments and never found one. The one and only dinosaur bone that he knows of was found by a graduate student of his.

Land surfaces may be eroded unevenly, even spectacularly. A hard cap rock can protect the softer sediments directly under it. Sometimes such a hard rock will shield a single pillar of softer rock from the ravages of erosion. Castle Rock is such a towerlike erosional remnant. Near the town also named Castle Rock, we saw this thin column of St. Peter Sandstone standing alone at the top of a small hill in the middle of a field.

Castle Rock may be made of the soft St. Peter Sandstone, but its surface is fairly hard. This surface has been protected from erosion by case hardening. As ground water seeps upward through the rock it carries minerals in solution. The ground water then evaporates. These dissolved minerals are left behind on the surface to serve as a cement. The surface sand grains become bound together with iron oxide and calcium carbonate, producing a relatively hard exterior, even though the interior rock remains soft.

Both the harder cap and the case hardened surface had kept Castle Rock intact until the present. Today the rock does not appear to be faring very well in resisting erosion. It has had too many visitors in recent times. It used to be larger. Until 1950 it consisted of two columns and was about 10 feet taller. Today one column is gone. Thoughtless people have carved too many initials through the protective case-hardened surface, and erosion has been greatly speeded up. One of the columns was reduced in size until one day someone decided it would be fun to push it over. The fragile St. Peter Sandstone landmark is no match for this sort of abuse, and Castle Rock may soon be gone.

Stream erosion can affect the land in different ways. The post glacial streams have made channels through to the Mississippi River in odd looking, oversized meanders. Near the southern Minnesota border meanders can be as large as six miles long with

valleys 600 feet deep, going around huge hills before they start to curve back. These meanders are too big to be made by the water being carried in today's streams. These large bends were formed when more water and sediments from melting glacial ice came down these water courses, and the huge meanders became established and incised.

We traveled down such an incised meandering stream. The road was built tracing the curves of the stream. We began at the top, at first traveling in relatively small, tight curves. As we descended the curves became larger and longer, and the valley deepened. The steadily enlarging amplitude and wave length of these meanders were very apparent as we swayed from one side of the valley to the other.

Tributary streams constantly feed their sediments into the Mississippi River, to be moved eventually toward the Gulf of Mexico. These tributaries carry a large quantity of sediments from their sandstone highlands. However, the Mississippi cannot always move these sediments effectively. The Chippewa River is a stream from central Wisconsin which flows more rapidly than does the Mississippi. Its sediment-laden waters slow down at the junction, and their sediments drop out forming a huge fan, or delta.

At the mouth of the Chippewa River sediments choke a wide portion of the bed of the Mississippi. They become an effective dam. The waters of the Mississippi are held upstream behind this dam, forming Lake Pepin. This natural river lake extends from Wabasha at the Chippewa's entry point to Red Wing about 30 miles upstream.

We got out of the bus at a highway overlook for a bird's eye view of Lake Pepin and the Chippewa River delta. The scene was spectacular. We could see the wide flood plain at the bottom, and how the main channel of the Mississippi had been pushed all the way to the opposite (Minnesota) side of the river. We could see the notch in the Wisconsin hillside which the Chippewa River had cut.

This magnificent place was an ideal spot to end a most enjoyable day. Here we had a lovely view of a dynamic, changing landscape. With Dr. Sloan's teaching, it was easy to picture how these changes were taking place. All day long he had stretched our minds to see beyond the rich agricultural land of today. He showed us that many other environments also had existed here, and that different kinds of living things had inhabited it as a result. His in-depth view of Southeastern Minnesota is one we won't forget.





PROPOSED REVISION OF  
BYLAWS  
GEOLOGICAL SOCIETY OF MINNESOTA

1. Rolling Address

The mailing address of the Society shall be that of the Liaison Officer.

2. Membership and Dues

The term membership in the Society shall be one calendar year, commencing January 1 and terminating December 31. Qualifications for membership shall be:

- A. An interest in the subject of Geology.
- B. Approval by the Board of Directors of the Society.
- C. Payment of dues fixed by said Board of Directors.

The annual dues shall be:

Adults (single membership) \$7.00  
Husband and Wife: \$10.00  
Student (full time) \$2.00

Members shall be declared in delinquency if their dues are not paid by February 1.

3. Annual Meeting

The Annual Meeting of the Society for the election of Directors and the transaction of other business shall be held the last Monday in September or, if, in any year, that date proves unavailable, as soon thereafter as practicable. Publication of the date, time, and place of the Annual Meeting in the next preceding issue of the official Society publication shall be deemed sufficient notice.

4. Quorum

Twenty percent (20%) of the membership in good standing shall constitute a Quorum for the transaction of all business.

5. Directors

The Directors shall be elected from the membership by a majority vote of the members present at the Annual Meeting. No less than two months prior to the Annual Meeting, the President shall appoint a committee who shall nominate at least one member for each vacancy on the Board. The names of the nominees shall be published in the issue of the official Society publication preceding the Annual Meeting. Any member may, with the consent of the Nominer, submit additional nominations from the floor at the Annual Meeting.

- 2 -

The term of office of the Directors shall be two years, commencing January 1 and terminating December 31 of the second year, or when their successors are elected and qualify. No Director shall serve more than two consecutive terms in office.

It shall be the duty of the Directors to manage the affairs of the Society, and of each Director to serve on the committee or committees to which he is assigned.

Meetings of the Board of Directors shall be at such time and places as determined by the Board, but generally once a month. If required, the President, or the Vice President acting in his stead, may call additional meetings. In addition, Board Meetings may be called by any three Board members acting together, who shall give written notice of such meeting to all Board members not less than five days before such meeting. Board meetings between the time of the Annual Meeting and January 1 shall be attended by both the incumbent Board members and the newly-elected Board members, except that the newly-elected Board members shall not be eligible to vote.

A majority of the Board of Directors shall constitute a quorum.

If any Director shall fail to attend three consecutive meetings without excuse, the other Directors may declare the office of such Director to be vacant. Vacancies in the Board of Directors may be filled by appointment by resolution of the Board for the unexpired term.

6. Officers

The Officers of the Society shall consist of President, Vice President, Secretary, and Treasurer, all of whom shall be elected by the Board of Directors from among its membership. The Election of Officers shall be held by the Board at the first Board Meeting following the Annual Meeting. The term of office of Officers shall be one year commencing January 1 and terminating December 31, or when their successors are elected and qualify.

The President shall preside at all meetings of the Society and of the Board of Directors, unless other arrangements are made. The Vice President shall perform the duties of the President in his absence. The Secretary shall record all proceedings of the Board of Directors, send copies of such minutes to each member of the Board for action at the next meeting, see that notice of all meetings is given, and take care of all correspondence of the Society. The Treasurer shall be the custodian of all funds due or belonging to the Society, and shall make a written report and accounting to

the Board of Directors at each regular meeting of the Board, and to the membership at the Annual Meeting. He shall cause to have published the Annual Report in the official Society publication. He shall deposit all funds in such bank as shall be designated by the Board of Directors, and withdrawals from such deposits shall be made only upon approval of the Board. He shall promptly file such information as may be required by the Internal Revenue Service. The Board of Directors shall appoint a member of the Society to audit the accounts at the end of the fiscal year. Otherwise, the Officers shall perform such duties as are commonly and usually performed by such officers. If any office becomes vacant, it may be filled by appointment by resolution of the Board for the unexpired term.

7. Liaison Officer

The Board of Directors shall appoint a Liaison Officer who shall primarily act as liaison between the Society and other related organizations. He shall serve as the mailing address for the Society, and be responsible for distributing all communications to the Society to the appropriate Officer or Committee. He shall be an ex-officio member of the Board, but without vote. Although the position is subject to re-appointment, the number of terms in office shall not be limited, and the position is intended to be stable.

8. Committees

The Board of Directors shall appoint a committee chairperson and vice chairperson for the following standing committees:

- A. Field Trip - To make all plans and arrangements necessary to present a series of field trips, and to cause the dates and destinations to be published in the official Society Newsletter.
- B. Museum and Archives - To collect, catalog, and file material relating to the history and activities of the Society.
- C. Membership - To solicit new members; to receive all membership applications and present them to the Board for its approval; to turn over all monies received to the Treasurer; to keep a current file of all memberships; including address, telephone number, and information helpful to the President in forming committees; to keep attendance at all meetings; and to publish yearly a roster of all members in good standing.
- D. Newsletter - To publish and mail to each member-family a bi-monthly newsletter giving notification of forthcoming Society events, news of Society members, and other items relating to the Earth Sciences; and to publish and mail such other information sheets on Society events as may be required from time to time.

- E. Lectures - To make all plans and arrangements necessary to present a series of lectures and accompanying laboratory meetings during the year; to publish the program in sufficient quantity for each member-family and for public information.
- F. Public Service - To promote an awareness of and interest in the study of geology in the schools and among the general public. This may be done by providing speakers, exhibits, literature, maps, or by such other means as seem appropriate.
- G. Publicity - To publicize the activities of the Society in the appropriate media and wherever it is believed an interest in the Earth Sciences may exist.
- H. Shows and Exhibits - To collect appropriate material, including literature, photographs, maps, and specimens for exhibit at such shows or events as shall be determined by the Board of Directors and to plan and manage such exhibit.
- I. Social - To make arrangements for the banquet and Annual Meeting, or any other social events.

The President may, with the consent of the Board, appoint such other temporary committees as may be deemed necessary.

Committee Chairpersons may be requested to report on the activities of their committees to the Board.

9. Fiscal Year

The Fiscal Year of the Society shall commence January 1 and terminate December 31.

10. Amendments

These By-Laws and any subsequent amendments thereto shall become effective upon approval by the Board of Directors and adopted by a majority vote of the Membership present at a regular or special meeting called for the purpose. Written notice of the time and place of such meeting, with a copy of the proposed changes to the By-Laws, or publication in the official Society Newsletter, shall be sufficient notice when mailed to each member-family at least one full week before such meeting.

Board of Directors Approval: 2/78  
Adopted by Memberships: